Gas Journal

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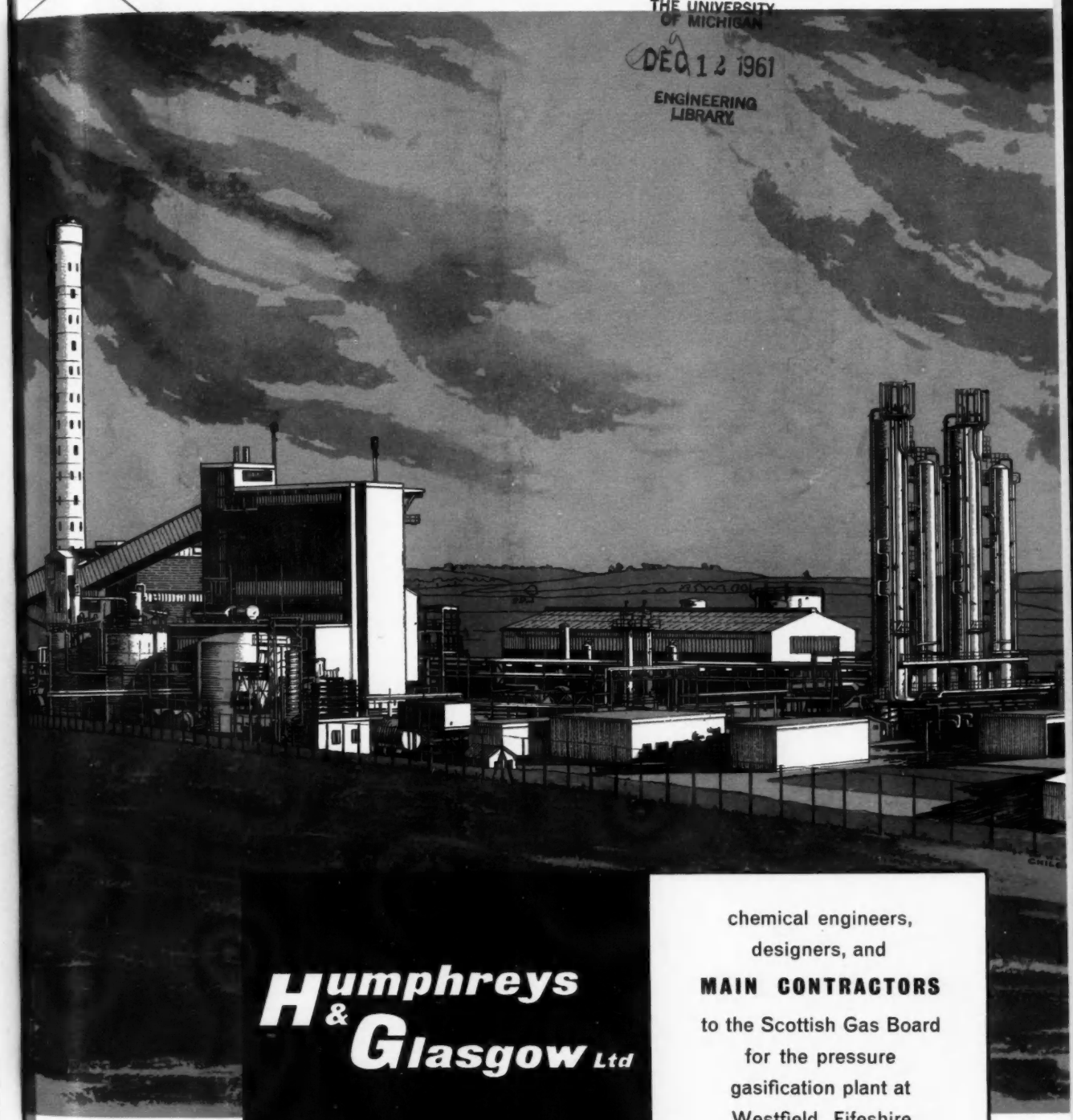

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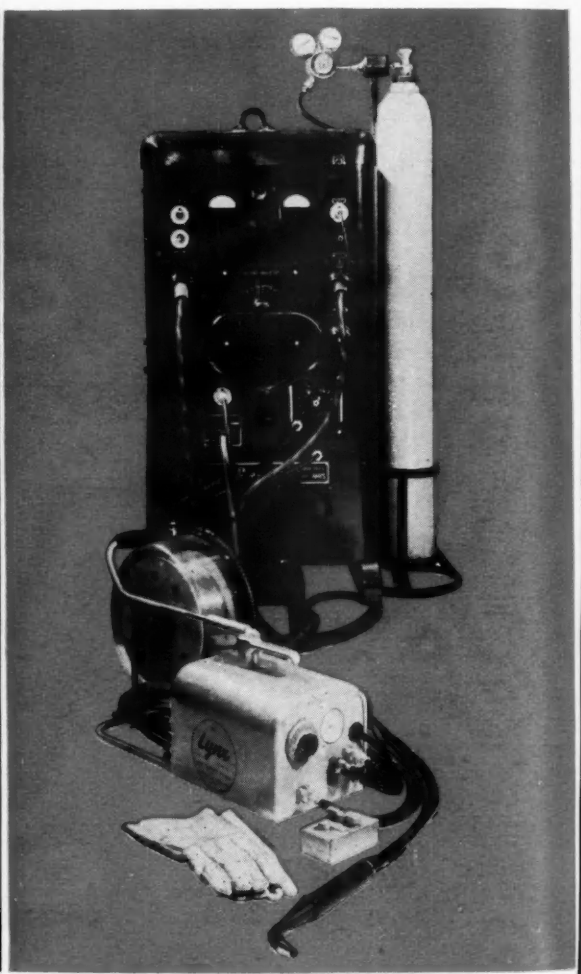

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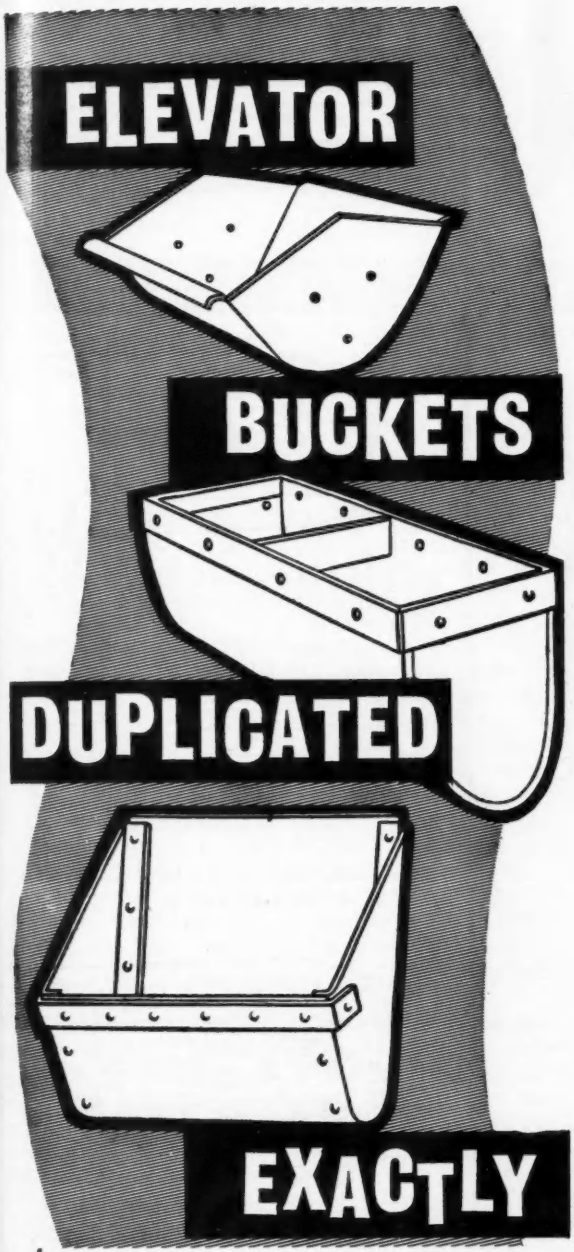

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Gas Journal

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WEDNESDAY, NOVEMBER 15, 1961

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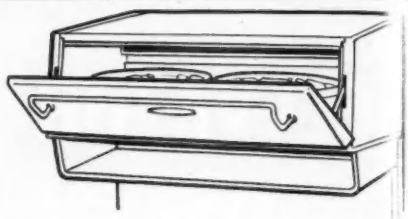

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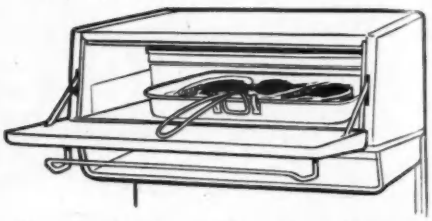

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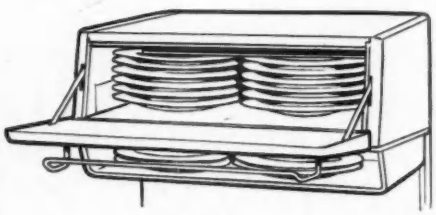

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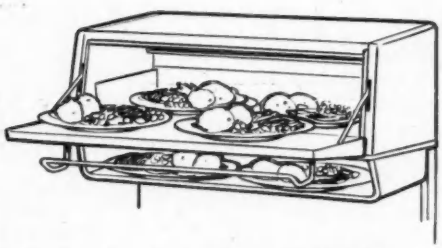

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Gas Journal

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A new spirit at Harrogate

WE cannot recall a Gas Sales and Service Conference so productive of genuine and valuable expressions of opinion as the seventh in the series, held at Harrogate last week. Attendance had been shaved down to about 700—still 200 too many, in our view—and a determined effort made to upgrade the standard of contributions. Discussion of the three major papers was carefully prepared and stage-managed; free-for-all was limited to fast-moving discussion groups. Informal talk was more constructive and more serious. A fertile climate was produced by a nice balance (never possible before) between, on the one hand, confidence and exultation induced by the undoubted upsurge of space heating business, and on the other, concern and determination regarding what one contributor called the shadows gathering round the cooking load. And shining brightly on this industrious scene was the news of methane importation, powerfully personified by the presence at the closing session of the Minister himself.

After a charmingly self-deprecatory welcome by the Mayor, who also happens to be the Chief Accountant of the North Eastern Gas Board, Sir Henry Jones, the Chairman of the Gas Council, set the theme of the conference, 'Sell More Gas,' and introduced Mr. W. R. Bowden, Chairman of the Institute of Market and Sales Management, who advised all present to 'Stop Gassing —Get Selling.' At first one felt a little inclined to ask him to follow his own advice, but after some wild sweeps on a wide, international canvass, the speaker narrowed his picture to more manageable and familiar proportions.

Gas, he said, had been a sick child and was now convalescing. To further its recovery, he put forward some very good suggestions. For example, he commented on the fact that nearly £1½ mill. was spent on technical research and, apparently, nothing on market research. He advocated the appointment of a marketing director; the establishment of an advertising appropriation based on appliance sales (at least £2½ mill. in total); the utilisation of T.V. advertising; a recognised house pattern style for showrooms; a unified price structure and standardised service, charges and fittings; and the co-option of ladies to marketing discussions.

Mr. Bowden's recommendations regarding national marketing were worthy of careful thought, and we would refer readers to the special issue of *Gas Service* which will carry a full report of the whole conference.

The first morning concluded with an example of culinary showmanship by the Bon Viveur team of Fanny and Johnnie Cradock.

After this rather tantalising hors d'oeuvres came the main course—a fairly solid one consisting of 'The Case for Gas,' in which the Deputy Chairman, Mr. W. K. Hutchison, explained how it was that the Chairmen of the three working parties at the Selsdon Park conference last October had come to prepare the papers for this Harrogate gathering, and illustrated the trends in gas and appliance sales. This was followed by 'The Domestic Space Heating Load,' a particularly comprehensive paper by Mr. A. F. Hetherington, the Chairman of the Southern Gas Board. In this he cautioned against complacency induced by too close a concentration on space heating results in the gas industry; a more effective yardstick, he suggested, was the record of sales by competing fuels. He sought a reappraisal of central heating advertising policy, a redoubling of efforts to influence builders, and a proper combination of central heating and room heating. For the last-named he examined the case for a 'subsidy,' the need for a low-priced heater for the mass market, and the advantages of selling 'freshness' in direct contrast to the 'fume image.'

Mr. Hetherington's paper began with the words: 'We have got one foot in the space heating market. With a concerted effort I believe we can leap right into it with very great benefit to ourselves and our customers.' And it concluded: 'Space heating is, in my opinion, our lifeline through the critical sixties; we must not for a moment relax our hold upon it.'

In the discussion which followed the emphasis was on the room heater rather than on central heating, and in the many points raised in connection with this appliance, the question of design loomed large. There was strong support for the view that although good contemporary design is of vital importance, something else may be required to win over the coal fire user with an old-fashioned room—although there was a word of warning against *too* many variations. The need to sell

surrounds with heaters was generally acknowledged, and so was the importance of fires in public view.

However, the room heater did not entirely monopolise things. Mr. Ernest Brooks, Managing Director of Pottertons, warned his audience not to bury central heating in the attempt to sell fires, and stressed the clear superiority of gas for this service. By comparing the relative sales in different areas he suggested that the industry was a very long way short of its potential in this field. Through all the contributions shone the need for more technical know-how, better dissemination of information, and greater attention to training. As far as educating the public was concerned, one had the impression that all home service advisers were positively agog to volunteer for this duty, and indeed their training and experience make them ideally suited for this vital task.

No magic formula

The scene-stealer during the discussion was Mr. L. F. Randall, Commercial Manager, East Midlands, whose Board's prowess in selling gas fires is a byword in commercial circles. There was, he confided, no magic formula, although tariff, price, advertising and special salesmen all played their part. One sensed the confidence engendered by a snowballing sales campaign and could appreciate what he meant when he quoted Wilde, 'Nothing succeeds like excess.' A sizzling performance!

The following morning brought a strong double bill with Mr. H. R. Hart, Deputy Chairman of the Scottish Gas Board, presenting a paper on 'Retaining the Cooker Load'—a much criticised title, by the way—and Dr. R. S. Edwards, Chairman of the North Eastern Gas Board, presenting another on 'Water Heating.'

In Mr. Hart's view the industry has committed the unforgivable sin of allowing gas cooking to become unfashionable; a 'dramatic gesture' (such as the coming of safer gas), more salesmen and a national standard cooker would help to improve matters. His paper carefully examined the ways in which business was being lost, and enumerated a variety of means by which gas cooking could be put on a pedestal and projected as a luxury within everybody's reach.

The national cooker

With the exception of the national cooker, which nobody favoured—indeed, it appears to us to be the very antithesis of fashion-making—and the publicity value of non-toxic gas, contributors to the discussion went along with Mr. Hart all the way. Miss Joan Langley, Chief Home Service Adviser of the South Western Board, had a good point when she suggested that it was time the industry stopped regarding as gimmicks features which were in fact genuine, modern aids. And Mr. Cooker himself, alias E. W. B. Dunning, proved a tower of strength, demonstrating, as did his Watson House colleagues, a knowledge infinitely wider than the too glibly attached 'technical' label. In a masterly summing up, Mr. S. G. Deavin, Deputy Chairman of the North Eastern Board, stressed the urgent need for a tremendous selling and public relations operation to establish the gas cooker as a status symbol. Cooking, he said, was our business, and the gas cooker must be sold on its merit and sheer superiority.

If the industry has tended to take the cooker load for granted, how much greater is the degree to which it has failed to exploit the water heating load? Dr. Edwards' reminder that water heating deserves to be more than the neglected relation of cooking and space heating was timely, and his paper served as a valuable statement of the potential market and the competitive position. He concluded that there was a great reward for the industry if it could supply a fool-proof, trouble-free, efficient and flexible apparatus for heating water at reasonable cost, and pleaded for a 'break through' akin to that recently obtained in the field of space heating.

Both Mr. J. A. Buckley, Sales Manager of the North Thames Board, and Mr. J. W. Rodgers, Sales and Service Manager of the North Western Board, made valuable contributions based on specific experience in their respective areas, and we were impressed by the arguments put forward by Miss Elsie Greig, the Advertising and Publicity Officer of the Scottish Board, who pointed out that cleanliness was a fashion, and fashion played a big part in women's thinking. Her insistence on the value of shape and colour may well have suggested to many present that their approach to the subject was dangerously narrow and mechanical. And there was an uncomfortable degree of truth in her assertion that 'What women want they get, and men provide it for them.'

Ran out of time

It was most unfortunate that this valuable session ran out of time, necessitating the curtailing of several contributions. Only Mr. A. W. Kidman, P.R.O. of the West Midlands Board, succeeded in making capital out of the usually off-putting request to be very brief. The cheerful manner in which he jettisoned pages of manuscript and began at the point where it said 'Finally . . .' earned him the biggest laugh of the conference.

The true test of the effectiveness of this substantial gathering lay in the three discussion groups into which delegates were divided on Wednesday afternoon.

On the next, and final, morning, Mr. Hutchison introduced 'The Conference in Retrospect,' in which four people summed up their main impressions of what had gone before.

Mr. L. W. Andrew, Director of Watson House Centre, said he had never felt a greater feeling of confidence and, somewhat ambiguously, described the atmosphere of the conference as 'quite electric'! The messages he would carry back with him would include the need to solve the back boiler problem, the need for two cheap fires of different ratings, the need to sell 'freshness,' and the need for a faster information service.

Mrs. Joan Robins, Home Service Adviser to the Gas Council, maintained that over 75% of domestic customers were women, but pointed out that a decision on such a thing as whole house heating was taken by a man. She felt there was a need for national thinking, and dismissed the importance which had been attached by other speakers to the question of toxicity; customers

would become really interested, she said, when gas became cheaper rather than safer.

Before the last of the quartet, Mr. R. J. Gregg, Publicity Manager of the Gas Council, delivered his characteristic MaxMillerian salvo, and had stressed the advantages of co-operative advertising, we had the big surprise of the conference. To most delegates, we suppose Mr. W. F. Edwards was something of a dark horse whose presence was explained only by Mr. Hutchison's assertion that his work at selling space heaters at Port Talbot (of which undertaking he is General Manager) made the East Midlands Board look like beginnners! Those of us who had heard Mr. Edwards in his native Wales were more prepared for the eloquence, wit and punch which followed. His ovation—far and away the heartiest of the two and a half days—was richly deserved.

There followed the top-of-the-bill appearance of the Minister of Power, reported elsewhere in this issue, the presentation of the Gas Council's Challenge Trophy to Miss Ann Bradford (late S.E.G.B., now, alas, removed to the Midland Bank), and the omnibus votes of thanks by Mrs. L. W. Roberts, Chairman of the W.G.F., and Mr. P. D. M. Aird, Chairman of Glover & Main Ltd.

So ended a conference which was a powerful tonic and, at its best, an inspiration. If future conferences are to be of this calibre, two years is far too long to wait for the next one.

The story behind the story

IF we may coin a phrase, 'the spirit of methane is in the air'; this may well describe the release from frustration that many leading gas engineers may be feeling now that another hurdle has been cleared in the campaign waged these last seven years for the importation of liquefied natural gas. That this has indeed been a battle none will deny, fought with all the weapons of exact scientific, technological and engineering research and observation, first to prove the possibility of bringing natural gas over long distances by sea and then to find how best to use it on arrival.

Up till now, however, we have had surprisingly little information about the steps taken in the technical field to accomplish this really remarkable feat of bringing quite safely, and avoiding all hazards, a very inflammable liquid, cooled to a temperature comparable with that of liquid air, and in bulk, across the Atlantic Ocean in the middle of winter.

We thought, therefore, that the paper we are publishing this week, 'Development of Techniques for Liquefaction, Storage and Transportation of Natural Gas' by Mr. C. G. Filstead, read before the XXXIII[e] Congrès International de Chimie Industrielle, would be of particular interest, not only for its obvious topicality, but also for what it can add to our present knowledge of the history of the project.

So far most of the published information has dealt with the underlying principles to be observed and the investigations necessary to the success of a project of this kind. It has recalled the work done by scientists in the past on the liquefaction of gases, both in the laboratory and on the commercial scale, stressing the economics of such projects and calling attention to their likely effect on the British gas industry.

Dealing with these particular matters are the paper by Dr. J. Burns and Mr. L. J. Clark read to the Institution at its annual general meeting in 1956, and a series of articles appearing in the 'GAS JOURNAL' the same year by Mr. J. D. Crecca Jnr.; that was some three years before a cargo had left the Gulf of Mexico, and a very great deal of work still remained to be done.

The present paper brings us right up to date. Mr. Filstead is an American and is the representative of Conch International Methane Ltd. in London, which has carried out a great deal of work in research and the practical application of the necessary scientific principles for the realisation of this project.

It is clear too that he wants the facts known; it may also be of more than passing interest that his audience was that of a French professional body. For surely the French are the only gas engineers in Europe who have not merely sufficient natural gas at home for their country's needs, but have access to immense quantities in North Africa, even after the foreseeable needs of Algeria itself have been met.

The laying of a pipeline under the Mediterranean Sea is clearly fraught with many and extreme difficulties, but the French are confident that it is quite possible. We have read about the trials that have taken place in laying experimental lengths at varying depths between the Algerian and Spanish coasts, and we have seen Gaz de France's quite remarkable colour film; so we are well aware of the enormous efforts being made. But would not the shipping of liquefied gas across this stretch of sea meet the need for an outlet for natural gas to Continental Europe?

We know that the exports of this gas are to be to other parts of Europe than France itself, and the shipping of increasing quantities to North European as well as Mediterranean ports might obviate the need for long pipelines passing through territory in which there are no consumers. Only the economics of the project will decide this, and so too will the ability to meet future demands of a type of 'batch' transport such as this.

It appears to us that an important factor in the exporting of the gas is the liquefaction plant at Arzew near Oran, and the economic size and load factor of this plant is likely to have an influence on the cost of the gas delivered on board the tankers.

Clearly trans-ocean shipments might normally be of little interest to the Americans, but the European market and the intense interest of British gas engineers did provide an incentive. At the same time the demands for very high standards of scientific proof at every step in the investigation, so typical of the European tradition of scientific discovery, have done a great deal towards ensuring the freedom from hazards of any kind in this very daring and forward-looking undertaking.

Development of techniques for—
LIQUEFACTION, STORAGE AND TRANSPORTATION OF NATURAL GAS

By C. G. Filstead,

DEPUTY MANAGING DIRECTOR AND MANAGER OF ENGINEERING OF CONCH METHANE SERVICES LTD., LONDON.

WHILE investigations into the possibility of bringing natural gas in barges from Bayou Long, Louisiana to Chicago by the Mississippi River were in progress, two significant external developments took place. The first of these was the change in the fuel situation in the Chicago area which rendered the original plan uneconomic, and the second was the development of interest throughout the world and, particularly, in Great Britain in the possibility of transporting liquid methane to overseas markets.

It was about this time that the Continental Oil Company became interested in the project and formed a new Company with the Union Stock Yards called Constock Liquid Methane Corporation, each with a 50% interest. It was also at this time that the Gas Council made a preliminary investigation and became interested in liquefied natural gas as a source of fuel for its industry.

PRESENTED TO THE 33rd. CONGRES INTERNATIONAL DE CHIMIE INDUSTRIELLE

After the successful development of the pilot tanker the Methane Pioneer, Royal Dutch/Shell, which had also for some time been studying the problem of transporting liquid methane acquired a 40% interest in Constock which was subsequently renamed Conch International Methane Ltd.

By 1951 and 1952 the science of liquefaction was already highly developed and used by air separation plants operating at even lower temperatures, −320° F. (−195° C.) than methane at −258° F. (−160° C.). Methane liquefaction plants had been built and operated in Cleveland in 1941 and 1952 and in Russia in 1945 and 1948 for peak load storage purposes. Even earlier, the U.S. Bureau of Mines had built and operated plants for many years for extracting helium from liquefied natural gas.

Certain types of stainless steel were known to be suitable for the low temperatures involved and stainless steel was used quite extensively in liquid air plants and liquid oxygen and nitrogen storage vessels. The properties of various aluminium alloys at low temperatures were well known and were suitable for this temperature range. Comparatively little experience had been gained, however, in the use of welded aluminium vessels at these temperatures. A considerable amount of excellent development work was done by the aluminium companies in subsequent years to determine the properties at low temperatures of aluminium alloys when welded. As a result it was established by 1956 that a welded aluminium vessel of a suitable alloy containing 5% magnesium, was completely satisfactory for use with liquid methane.

The properties of various insulating materials at these low temperatures were not as well known. An intensive and very expensive research programme led to the development of a suitable and economic insulating system, *i.e.*, ductility at the low temperatures, impermeability to liquid and gaseous methane, sufficient strength to support the tanks and good insulating properties.

Large capacity low temperature pumping equipment was also a problem, though suitable small scale equipment was in operation in air separation plants. It was therefore necessary, with the help of established pump manufacturers, to develop much larger equipment.

At that time too essentially no work had been done on developing ships or barges for the transport of such low temperature products.

Pure methane is the lightest of the hydrocarbons. In the liquid state it has a specific gravity of .425 (water = 1), or a density of 3.54 lb. per U.S. gal. (4.23 lb. per Imp. gal.), a boiling point of −258.7° F. (−161.5° C.) at atmospheric pressure and an absolute viscosity of approximately .2 centipoises. In the gaseous state it has a specific gravity of .555 (air = 1 at S.T.P.), a c.v. 1,012 B.t.u. per cu.ft. (9,500

kCal per cu.m.), limits of inflammability in air between 5% to 15%, an ignition temperature of 1,170° F. (630° C.) and a flame velocity of approximately 1 ft. per second.

Most natural gases contain some of the heavier hydrocarbons, and as their proportion increases, the boiling point becomes higher and the liquid and gas density also increase.

The natural gases available for liquefaction and transportation vary widely in composition. The properties of a typical flare gas (produced in association with oil) available in the Middle East compared to gas from Hassi R'Mel (from a gas-condensate reservoir) are shown in Table 1.

TABLE 1

Composition	Middle East flare gas	Hassi R'Mel gas
Methane	72·7	87·5
Ethane	16·5	8·3
Propane	6·8	2·4
Butane	2·5	1·1
Pentanes plus	1·5	·7
Boiling point at atmospheric pressure ..	−253°F	−256°F
Calorific Value	1,359 B.t.u. per cu. ft. (12,900 kCal. per cu.m.)	1,087 B.t.u. per cu. ft. (10,340 kCal. per cu.m.)
Specific gravity of liquid	·52	·47

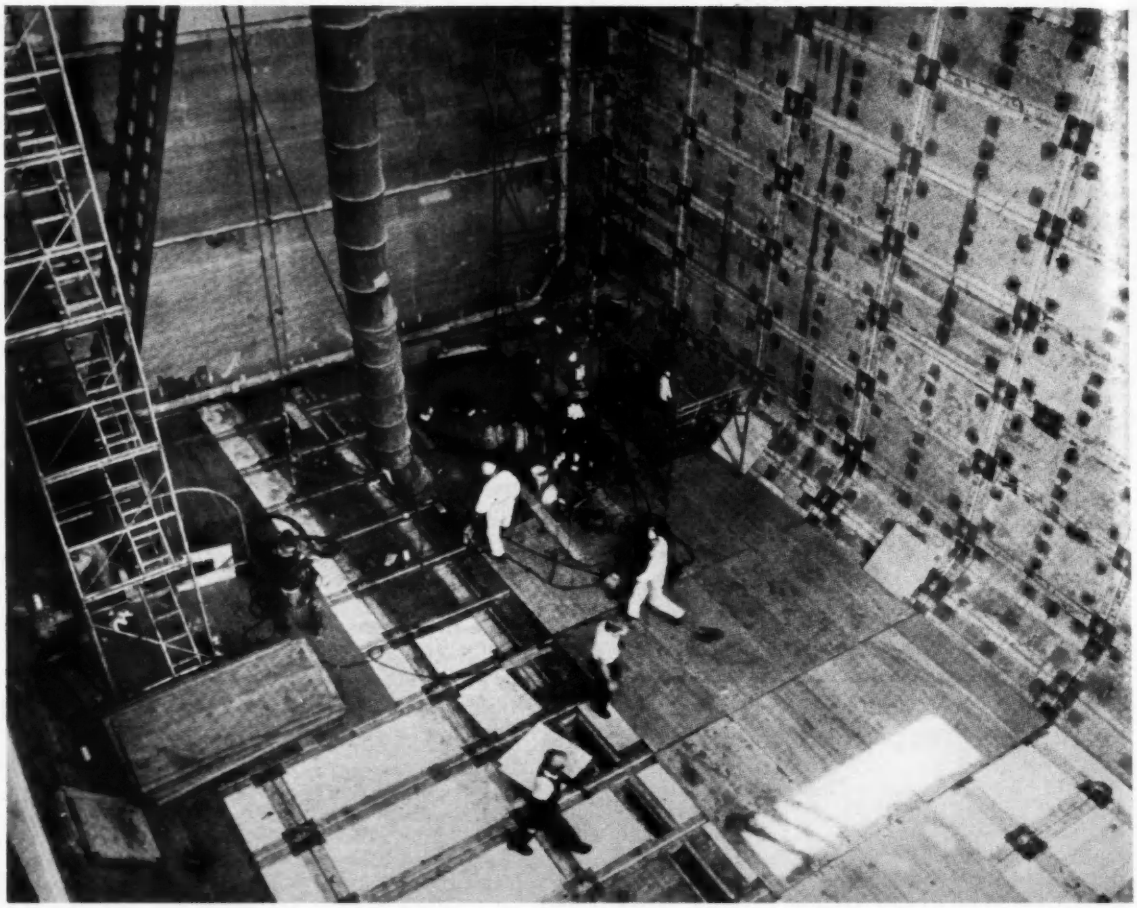
Either of these gases can be readily liquefied in the same type of plant, the rich gas requiring slightly less power per cu.ft. of gas than the lean. The power required would be of the order of 450-500 b.h.p. per mill. cu.ft. per day, depending on quantity of the heavier fractions.

Most gases at the wellhead will contain appreciable quantities of hydrogen sulphide, carbon dioxide and nitrogen, and prior to recent developments by Conch, the two former would have had to be removed before the liquefaction process by commercial methods—in some cases, it still may be economic to do so. Any water vapour present must be almost completely removed by the conventional drying methods of lowering the dewpoint of the gas to below minus 100°F. (−73° C.). At liquid methane temperatures the nitrogen is substantially non-condensible and its removal at the end of the liquefaction process can be easily accomplished by a stripper column.

Over the past few years a patented process for the removal of carbon dioxide and hydrogen sulphide by freeze-out in the liquefaction process has been developed, which is relatively simple and can replace the more costly commercial method. It is most valuable where the CO_2 and hydrogen sulphide contents are higher than 1 or 2%, but it can be used at even lower concentrations.

From the beginning safety and reliability have been the watchword. In the design of ships, tanks and plants they

Aluminium cargo tanks for the 'Methane Pioneer.'



Insulated hold on the 'Methane Pioneer,' with one tank in place.

have always been given prime consideration, even at the expense of higher costs. The liquefaction plants and storage tanks have been designed in accordance with existing U.S. Codes and Regulations. The Methane Pioneer and the larger ships have been designed in accordance with the U.S. Coast Guard Regulations and the requirements of both the American Bureau of Shipping and Lloyds Register of Shipping.

Over the past years tests made to determine the comparative safety of handling and storing liquefied natural gas, especially in a recently completed series of fire tests at Lake Charles, have conclusively demonstrated that liquid methane is no more hazardous than gasoline, propane and butane.

Gas liquefaction on an industrial scale has been said to date from 1895 when Carl von Linde first used the cycle invented by him to liquefy air. As for natural gas liquefaction plants of commercial size, the first was a 4 mill. cu.ft. per day (41 mill. cu.m. per year) cascade plant for peak shaving started up in Cleveland, Ohio, in 1940. A plant of similar size and design was later supplied by Dresser Industries for installation near Moscow. The first of several plants for separation of helium from natural gas by partial liquefaction was built in Texas in the 1920's.

The theoretical minimum work required to liquefy gas is a function only of the initial state of the gas and the final state of the liquid; it is independent of the type of cycle used, and it can be calculated from the equation,

$$Wr = To\ \triangle S - \triangle H.$$

where Wr = minimum (or reversible) work, To = temperature of environment to which heat can be rejected, $\triangle S$ = reduction in entropy between initial and final states, and $\triangle H$ = reduction in enthalpy between initial and final states.

For pure methane initially at 34 atmospheres and 100° F. (38° C.) and finally liquid at atmospheric pressure and −258° F., (−161.5° C.) the foregoing relation gives a theoretical minimum power requirement of 185 h.p. per mill. cu.ft. per day liquefied, (117 kWh per 1,000 cu.m. liquefied). Actual work will run between 450 and 1,000 h.p. per mill. cu.ft. per day of gas liquefied (285 to 632 kWh per 1,000 cu.m. liquefied), depending primarily on kind of cycle employed. We consider 450 h.p. per mill. cu.ft. per day (285 kWh per 1,000 cu.m. liquefied) to be approaching an economic minimum.

The cascade cycle used in the East Ohio Gas Company's plant had a rated production of 4 mill. cu.ft. per day (40 mill. cu.m. per year) with a power requirement of 2,650 h.p. and a fuel consumption of about 15% of feed gas. Compressors were of the reciprocating type driven by gas engines.

The design capacity of our liquefaction barge plant is 7 mill. cu.ft. per day (70 mill. cu.m. per year). Since a cascade cycle of this capacity would have required gas engine-driven reciprocating compressors, and a rather large

space to accommodate all its components, a modified Claude cycle with lighter and more compact centrifugal machinery and fewer components was chosen. This cycle was less efficient with consequently greater installed horsepower, but the requirement for compactness is much less important for land based installations.

The Constock patented liquefaction barge cycle has a power requirement of 7,000 h.p., and fuel consumption runs at about 30% of the total feed gas. Recycle compressors and the Freon precooling unit were of the centrifugal type driven by steam turbines. In general, results show that barge mounted equipment is more expensive to operate and more expensive to maintain.

Between 1954 and 1956 we were faced with a different problem in selecting a liquefaction cycle. Preliminary estimates made in 1954 for investment and operating costs of plants and ships for a full scale commercial project had indicated that a lower cost and a more efficient plant was required if this project was to be commercially feasible.

After a considerable amount of work a more sophisticated cascade cycle was developed and patented, on the basis of which preliminary estimates indicated that a full scale commercial project was feasible. At the same time ship designs were being improved.

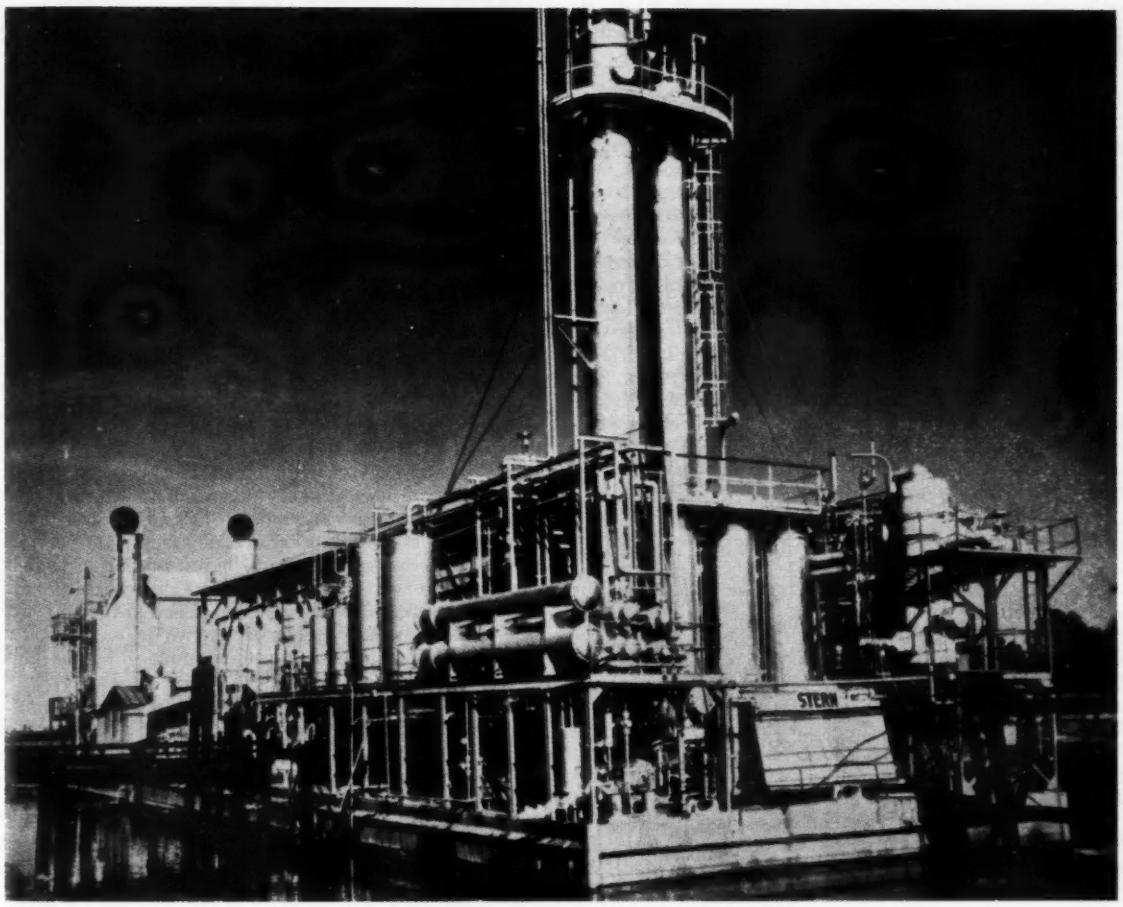
By 1955 preliminary discussions had been begun with the Gas Council to consider the next step which was to be a large scale test operation to prove the technical developments, primarily of the tanker.

With the help of the J. F. Pritchard Company, design and construction engineers with experience in air separation and gas treating plants, a complete plant with a very low installed horsepower, a good fuel economy and a low capital cost was devised and the work completed by 1957. This plant would be built in three streams the total output of which is 102.5 mill. cu.ft. per day (about 1,000 mill. cu.m. per year). The total power requirement is 46,900 h.p.—fuel consumption will be about 8% of total feed gas, and gas engine-driven reciprocating compressors will be used throughout.

Comparing the refined Conch cascade cycle to the East Ohio Gas cascade cycle, horsepower requirement per mill. cu.ft. per day of gas liquefied has been reduced by 30%, and fuel requirements to less than 10%, an achievement due mainly to the use throughout of smaller average and final heat exchanger temperature differences, and a greater number of refrigerant compression stages, by which small temperature differences and inter-cooling reduce compression work. This does, however, result in greater complexity and relatively larger heat transfer surfaces, but both are justified in plants as large as those we have in mind.

We have also done considerable work on turbo-expander type cycles built around centrifugal machinery, on the principle that in large capacity plants centrifugal machinery costs less per horsepower than reciprocating machinery. Although we have been able to devise cycles and plants which are a tremendous improvement over the original

Constock liquefaction barge with a capacity of 7 mill. cu.ft. per day.



cycle used on the liquefaction barge, the total installed horsepower and fuel consumption remains out of economic range of the cascade plant for projects of immediate interest to us. This conclusion was reached after a detailed design and cost study similar to that made for the cascade plant.

For an output of 100 mill. cu.ft. per day (1,000 mill. cu.m. per year) it is estimated that this cycle with centrifugal compressors would require about 54,000 h.p. Fuel consumption with a combined gas turbine-steam turbine plant is estimated to be slightly above 10% of total feed gas.

Under certain conditions, however, the turbo-expander type cycle should show an advantage over a cascade plant —where the price of gas is extremely low, say 5c. per 1,000 cu.ft. (.87 NF per 100 cu.m.) and fuel economy is therefore not such an important factor, or where continuity of operation does not rule out the use of large single modules as it does for a first liquefaction plant.

PARALLEL STREAMS

For the first plant at Arzew for instance, there must be sufficient parallel streams to ensure that the plant will continue to operate at all times, even though it may be at reduced capacity. Once several liquefaction plants are in operation this need for reliability is somewhat lessened, since the various plants tend to support each other. Thus, as the total liquefaction plant capacity available, say in Africa, increases to 300 or 400 mill. cu.ft. per day (3,000 or 4,000 mill. cu.m. per year) subsequent plants can be built which will utilise a single liquefaction unit, in which centrifugal compressors driven by one main steam, or gas turbine, may show a decided capital advantage which would offset any loss of fuel economy.

Before we contracted for the building of a 35,000-bbl. (5,560 cu.m.) land storage tank at Lake Charles the capacity of the largest tank previously built for liquid oxygen and liquid nitrogen storage had taken approximately 15,000 bbl., all such tanks being of double tank construction with the inner built of stainless steel. During discussions on the bigger tank, however, it was discovered that significant savings could be made by using aluminium for the inner tank rather than stainless steel, but because of its higher co-efficient of contraction, aluminium brought additional problems in compaction of the insulation; a similar problem was faced by the North Thames Gas Board in the building of their two 15,000-bbl. tanks at Canvey.

This tank has now been in operation at Lake Charles continuously for some two years, and is completely satisfactory in all respects; the daily boil-off rate is about .1% per day and it is completely free from any gas or liquid leaks.

NO INTERNAL LINER

Another significant development in land storage by our research department is the storage of liquid methane in the ground with no internal liner. At present we are testing a 20-ft. diameter by a 20-ft. deep ground storage tank at Lake Charles. Tests have now been going on for several months and have proved the concept to be fundamentally sound. They should give comprehensive data on freezing of the ground, conductivity of the frozen ground and similar information which can be used to design extremely large tanks of this type.

The design of the liquid methane barge which we built in 1954 and 1955 and tested in 1956 was not the same straightforward engineering problem as the liquefaction plant. We were faced with the problem of developing an insulation system which could be installed at a reasonable cost and, at the same time, would provide either a primary or secondary barrier which could resist the effects of the liquid methane.

Countless types of insulation were tested, including many foam plastics, but most of these had to be eliminated on the basis of either cost or loss of mechanical or physical properties at −258°F. (−161.5°C.).

Finally, balsa wood was selected as the most suitable material, since it retains its physical characteristics at the low temperatures, it has good insulating properties and can be made into a tank which would contain the liquid methane, an important factor since it was subsequently to provide the secondary barrier for the present design of liquid methane tankers. The manufacture of these balsa panels and balsa tanks is more of an art than it is a science.

The types of glue and coatings and methods of fabrication and lamination had to be developed by trial and error since the reaction of these various materials is difficult to predict at the low temperatures. For instance, various glues in stick form are brittle at liquid methane temperatures, but when applied to balsa with laminations in very thin coatings, they retain their ductility at the low temperatures and when subjected to tensile tests will not fracture.

PROTOTYPE TANKS

After building and testing with liquid nitrogen many prototype tanks made from balsa, it appeared that the large barge tanks each with a capacity of 7,000 bbl. could be built with a 12-in. continuously laminated balsa lining with no inner tank, *i.e.*, the liquid methane would be in direct contact with the balsa. In spite of the success of these many small scale tests, large scale tests showed that when these tanks were filled with liquid methane the surface of the balsa wood, after long periods of exposure, was damaged when the tanks were warmed up.

There have been many modifications and changes in the methods of installing the balsa insulation system, but the fundamental principles have always been retained. We have continued to improve upon the design and to reduce the total cost.

FULL SCALE TESTS

The methane barge also provided full scale tests for a centrifugal deepwell pump with a very low net positive suction head, liquid piping systems, venting systems and safety instrumentation which were utilised subsequently in the design of the Methane Pioneer.

In 1954 and 1955 when the ocean transportation of liquid methane was first seriously under consideration, many studies and a considerable amount of primary design work was done to establish the basic configuration of the vessel. At that time vertical cylindrical tanks, horizontal cylindrical tanks, spherical tanks and rectangular tanks in relation to the economic utilisation of space in the ship were studied. Rectangular tanks were shown to be best on an economic basis since they utilised most fully the cubic capacity of the ship.

This configuration decided upon, there were three main problems to be solved, two of which were not inherent in the barge tank design.

First was the design of the self-supporting rectangular tanks to hold the stresses due to hydrostatic and dynamic forces, and also the thermal stresses within allowable limits. Secondly, the method of supporting and locating these tanks within the insulated hold and transmitting of the tank forces into the ship's structure. Thirdly, the design of an

in ulation system which would not only hold the boil-off to an economic level, but would also act as a secondary barrier to contain the liquid methane in the remote case of a leak developing in the primary tank.

The floor insulation also had to be designed to support the full weight of the cargo tanks and transmit through a patented key system the tank forces into the ship's structure. The problem of pumping, pressure control, transfer lines and safety instrumentation was not so critical since from our previous experience with the methane barges these problems were essentially already solved.

Once the rectangular tanks had been selected additional design problems arose. Test operations with the liquid methane barges at Bayou Long had shown that there is an extremely severe temperature gradient in the tank in the first few feet above the liquid level. This raised the question of thermal stresses which could be a serious problem, particularly in a flat-sided rectangular tank with internal stiffeners. It became obvious that a further detailed analysis of these thermal stresses would have to be made by a highly qualified mathematician-stress analyst, and the theory and formulae derived by him to be subsequently checked by large scale prototype tank tests.

COMPLETELY INSTRUMENTED

As a result of the analysis carried out by Professor Reisner of the Massachusetts Institute of Technology, an aluminium prototype test tank 10 ft. by 12 ft. by 16 ft. was built.

In 1956 it was tested with liquid nitrogen and completely instrumented with strain gauges to verify the thermal stress levels at various points on the tank. The theoretical analysis was thus verified by the use of these generalised formula, which have been converted for use with digital computers, it is now possible to design various sized tanks and rapidly check the thermal stress levels.

The solution to the second major problem, that of location and supporting the tanks within the insulating holds was solved by the use of patented keys and keyways located on the centre line of the tanks, top and bottom.

The third major problem was the design of the combined insulating system and secondary barrier. Because of the rectangular shape of ships holds, and the natural irregularity of steel work in ships, the design used in the barges was modified to the extent that instead of continuous laminations, shop fabricated panels 4 ft. by 8 ft. by 12 in. thick and of patented design were used and connected by liquid tight expansion joints.

SYNTHETIC RESINS

Many test samples combining various synthetic resins and other materials were fabricated and tested until a complete system was devised that was satisfactory not only as an insulating system but one that would contain the liquid methane in case of a leak in the main tanks.

The conversion of the CI-M-AVI type dry cargo vessel to carry 32,000 bbl. of liquid methane got underway in the latter part of 1957.

The design of the insulation system for the Methane Pioneer had been worked out, the original hull was to be partially rebuilt and increased in depth, and an inner hull installed making it a double hulled ship.

The No. 2 and No. 3 holds were insulated with balsa wood on the bottom and sides. The top of each hold is insulated with fibre glass. The No. 2 hold contains two aluminium tanks with capacities of 6,500 bbl. and 6,000 bls.; and No. 3 contains three aluminium tanks with a capacity of 6,500 bbl. each.

The aluminium cargo tanks are of welded construction throughout and all shell seam welds were 100% X-rayed. They were designed to be self supporting and of sufficient strength to withstand the hydrostatic pressure of a .6 sp. gr. liquid, plus an imposed gas pressure, plus a dynamic load caused by the ship's movement.

There are no bottom connections to the tanks and all normal piping for liquid, gas vents both normal and emergency, instruments and the pump drive shafts are extended through the trunk top and are arranged above the weather deck. The piping above deck is mainly stainless steel, with stainless steel flanges, fittings, bolts, valves and bellows-type expansion joints.

Each cargo tank is equipped with (*a*) a deepwell type centrifugal pump driven through a vertical shaft by a Class 1 Group D explosion proof motor above deck for unloading cargo, and (*b*) a blow case type pump operated by compressed gas for stripping the remaining liquid from the tank.

Two centrifugal pumps are provided on deck to receive the liquid from the deepwell pumps and boost the pressure for delivery to shore connections.

The only attachment of the cargo tanks to the ship's structure is by a special insulated key arrangement which prevents the tanks from shifting owing to the ship's motion and/or thermal movement.

The space between the cargo tanks and insulation in each hold is supplied with dry nitrogen and held at a very low positive pressure to prevent breathing in of air which would occur with temperature or barometric pressure changes. This system positively excludes moisture from the insulation and also provides an inert gas atmosphere in the insulation space. The gas composition in the insulation space of each hold is continuously monitored by an infra-red analyser, which is arranged to sound an alarm in case any gas from the cargo is present in the insulation space.

DETECTING SYSTEM

A further detecting system consists of a series of thermocouples attached to the sides and bottom of the inner steel hull, to the cargo tanks, to the insulation, to the keys and connected to a continuous monitoring instrument with a recorder and warning system.

The difficult problem of ship-to-shore delivery is achieved by the use of specially designed articulated stainless steel loading arms with ball joints. A special aluminium swivel joint and a special flexible type of hose made up from Terylene fabric and film armoured with stainless steel wire, have been tested and used.

Upon completion of the Methane Pioneer in October, 1958, all its special features were thoroughly tested with liquid methane at Lake Charles as well as during sea trials in the Gulf of Mexico. Then, on January 28, 1959, it left Lake Charles carrying a full cargo of 32,000 bbl. for the long voyage across the Atlantic to England. This was the first time anyone had ever attempted to transport liquefied natural gas by sea before, and the object was to prove the safety and feasibility of the special low temperature systems developed after several years costly research and engineering work.

As everyone with an interest in shipping now knows, this voyage and subsequent voyages between Lake Charles and Canvey Island were completely successful, and have conclusively demonstrated to the world that ocean transportation of liquid methane is technically feasible.

In all the Methane Pioneer was in operation carrying

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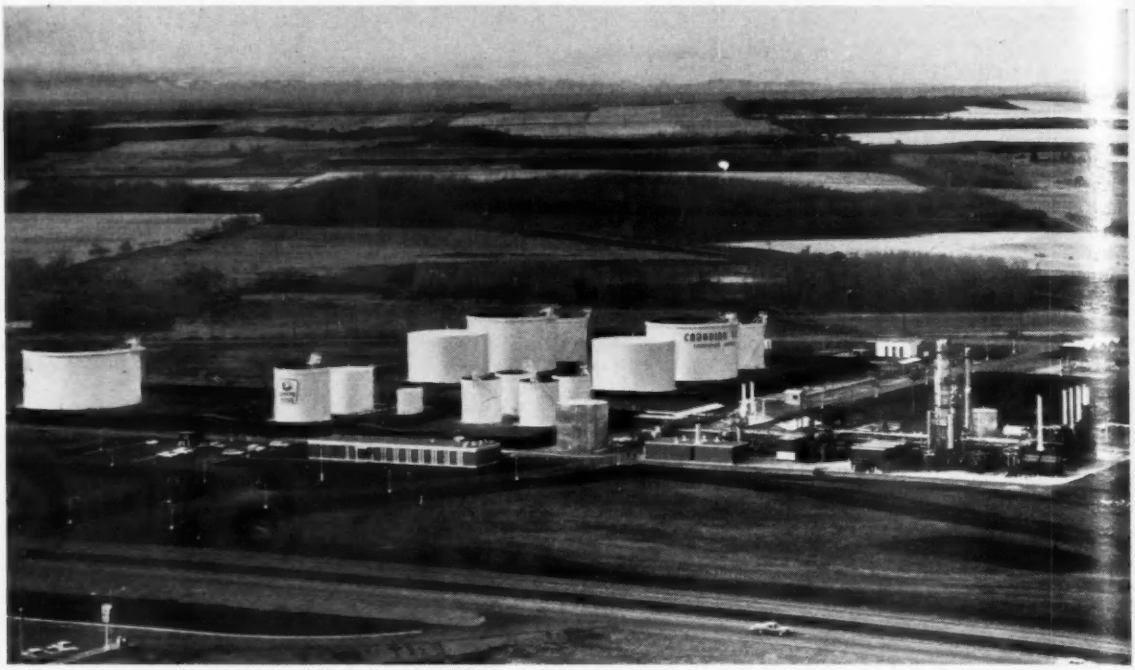


REFINERY IN NATURAL GAS FIELD— THE FIRST IN CANADA

By Hugh G. Jarman

IT is not news when a petroleum company constructs an oil refinery near an oil field. It is news, however, when a petroleum company constructs a refinery in a gas field.

The Canadian Oil Companies have done just that—right in the heart of the Alberta natural gas fields. A complete refinery has been constructed to operate entirely upon the by-products from these fields.

The only one of its kind in Canada, and one of the few in the world—to operate exclusively on natural gas by-products—it is also one of the very few air-cooled refineries in the world.

Canadian Oil Companies engineers say that this is a special kind of refinery, designed and constructed to use by-products from the gas fields. The location was one of the worst that could possibly be chosen for a refinery; first, there is no water and refineries use great quantities of water, and secondly Alberta winters are some of the coldest in Canada; everything liquid freezes or slows to a motionless state, but liquid must flow in a refinery processing plant.

This refinery has a normal capacity of 30 mill. imperial gal. of gasoline, about 8 mill. gal. of diesel and fuel oil annually. The cost of construction was $5 mill. It is the first condensate refinery to be built in Canada, and it has many novel features, including its low capital cost. This stems from the characteristics of natural gas condensate.

This feedstock has a high gasoline yield, and requires less processing than crude oils, although the refinery can use crude oils for refining should an emergency arise.

The natural gas condensate has a gasoline yield of 80% with 19% distillate fuel oil, it is relatively easy to separate and process into high-grade products. For this reason the usual high capital cost refinery generally required for the processing of crude oils is not necessary.

There are abundant supplies of this feedstock available as the processing of raw natural gas is stepped up to take care of the ever increasing demand for natural gas in Canada and United States.

Integration.—The process area is a single integrated unit

rather than the usual collection of individual process units. The four main processes, feedstock, fractionating, Merox treatment, unifining and platforming together with the auxiliary equipment are closely knit on the natural flow process of the product.

This design eliminates large intermediate storage and pumping requirements, although such facilities have been made for emergencies. If the feedstock is fed directly from one process to another the re-heating requirements are reduced, so less piping is necessary, a smaller plot plan is permitted and control of the entire processing operation can be more easily established and consolidated.

Automation. — Practically the whole of the processing cycle is controlled from a central panel. This keeps operator requirements to a minimum, in fact the entire refinery is operated by 26 men which include the office staff, watchmen and truck drivers.

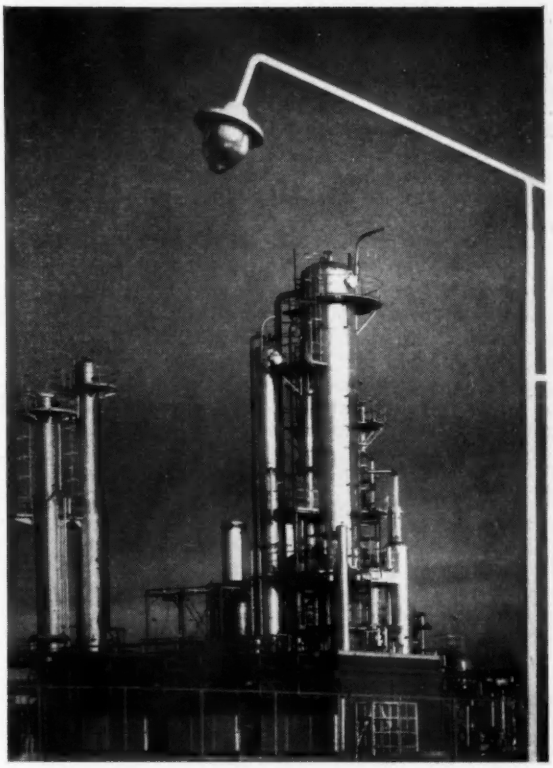
Electronics are used for sensing devices on the process units, for recording and indicating instruments on the control panel, and for all air-operated process valves on the units. Air for the valve-operation is dried in a unique silica gel system which absorbs moisture.

The electronic control system gives instant and sensitive response, immunity from weather conditions and ease of maintenance by standardised-unit components for easy replacement. There are 80 electronic loops, 44 with chart recorders and others with indicators.

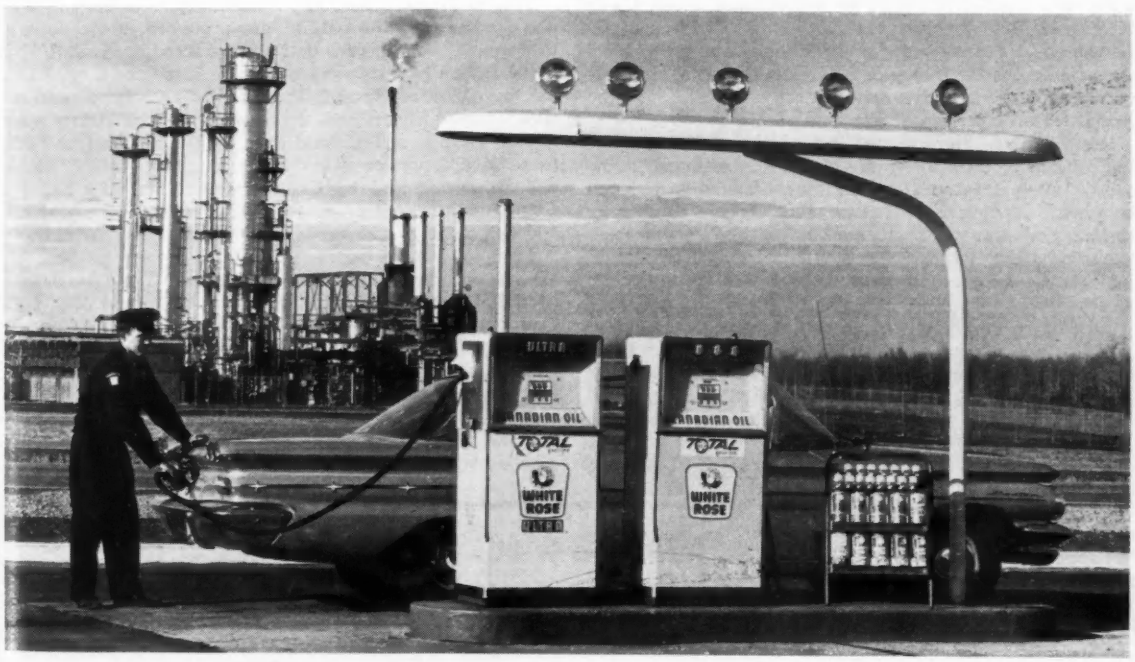
The control panel has permanent line diagrams to assist operators to visualise the process. Some of the electronic loops have standby direct-reading instruments on the units. Readings are recorded in a log book every two hours by the control room operators.

The quantity in any finished-products storage tank can be read instantly at the control room; each tank is equipped with an electronic gauge and the control operator simply dials a number representing the tank, similiar to that for dialing a telephone number in your home. The moment the code number has been completely dialed, the exact quantity of material in that tank is shown on an illuminated window above the dial.

Air-cooling.—This is the only plant in Canada completely



A street lamp frames the crude fractionating unit (above) at Canadian Oil's new Alberta refinery. The platformer/unifier towers are on the left. This filling station attendant (below) almost seems to have a direct line to the process units in the background.



air-cooled for all its processes. The giant cooling units embodying finned tubes, through which the products flow, are suspended above large fans producing a continuous strong wind. The rapidly moving air removes the heat from the tubes and fins. There are three main air-fin cooling stations which move over 1 mill. cu.ft. of air per minute.

Before going to the air-fin coolers, the product flows through heat exchangers, transferring some of its heat to preheat incoming feedstock. This arrangement heats up the feed, cools the product conserving heat and reduces costs.

Water.—No water being available for the refinery, the Company had to search for underground supplies and dig wells. After months of drilling it finally found a farmer who had a well on his property—bought out the farmer, moved his home and barns to another location, laid a pipeline to his new location to supply him with water—then piped its own requirements across to the refinery. This plant uses only 15 gal. of water a minute as against the usual 30,000 gal. for plants of this size. It might be mentioned that before buying out the farmer the Company drilled 13 wells where water was indicated to a depth of over 1,000 ft., but no water was found.

To economise in steam, all units are electrically driven, twin power supply lines running into the refinery, one from Edmonton and the other from Calgary, with a V8 120-h.p. gasoline-driven emergency generating set, which is able to cut-in automatically should there ever be a total power cut.

Liquid cooling. — Liquid cooling has been minimised as much as possible, and where used runs through a closed circuit into radiators similiar to those used on combustion engines; glycol anti-freeze has been added for temperatures down to 65° below zero, and this system recirculates the cooling water and eliminates waste.

Cold weather precautions. — Because of the intensely cold winters in Alberta, the main use of steam at the refinery is for heating buildings and steam tracing. There are several miles of small diameter copper tubing stretched along and around the pipelines, around all tanks or drums and across all instruments exposed to the cold. High temperature steam is passed through the tubing, preventing ice from forming and keeping the viscosity of oils at practical levels.

The system is so designed that all steam from the tubing is returned to the boilers for recirculation. As a further protection against cold and loss of internal heat, all process piping and vessels are insulated by more than a 3-in. thickness of mineral fibre. This is in turn completely covered by thin aluminium sheeting, which acts as added protection and improves the appearance.

In practice, the natural gas flows through pipelines to the gas processing plant, from which the condensate is piped to the refinery, where it is converted to gasoline, naphtha, distillate fuel for diesels, domestic fuel oils and heavy bottoms. These heavy bottoms are used in the refinery as fuel. The refinery also turns out butane.

All products from the refinery are sold within trucking distance of the plant.

CONTINUED FROM P. 255

LIQUEFACTION, STORAGE AND TRANSPORTATION OF NATURAL GAS

liquid methane for some 13½ months, and made seven trips, delivering just over 12,000 tons of cargo. On some occasions severe weather was encountered with winds up to 60 m.p.h., and with angles of roll up to 45°. Under these conditions the ship showed good sea keeping qualities and never took a heavy sea on deck. At all times the special features performed excellently.

The Methane Pioneer was not designed for regular long distance transportation of liquid methane. She is too small and too slow for that. She was designed to prove conclusively that a safe means had been devised for transporting liquefied natural gas, which was adaptable to larger scale commercial operation. After the seventh voyage, it was clear that this objective had been achieved, and there was nothing further to be gained by continuing with what was a rather expensive experiment.

After the test operation the Methane Pioneer was chartered to Texas Butadiene International, and since April of 1960 she has been used to transport butadiene (at about 26° F.) from Houston to Europe. For this service existing shipboard equipment was adapted to recondense the valuable butadiene boil-off. Since April, 1961, Texas Butadiene have used the Methane Pioneer to make deliveries of l.p.g. from the Gulf Coast to La Plata, South America.

Commercial-sized methane tankers will be built along the lines of the Methane Pioneer. It will however, be possible to incorporate several improvements as the result of the experience gained with this vessel and from the comprehensive programme of research carried out by Conch and its consultants. Current thinking is directed towards the construction of 170,000-bbl. ships, large, rather fast, fine, double-hulled ships, with an operating speed of 17.5 knots, which could carry the cargo in nine prismatical, self-supporting tanks, inserted into three insulated holds and keyed at top and bottom. Propulsion will be by steam turbine machinery.

These methane tankers will be exceptionally deep, in view of the low specific gravity of liquid methane, to give the required volumetric capacity, and will be approximately equivalent in size to a 28,000-ton oil tanker.

The first large scale commercial project has been organised for transporting natural gas produced in the Sahara to England. The plan is that gas produced at Hassi R'Mel in the Sahara by a subsidiary of S. N. Repal and C. F. P.(A) will be delivered through the recently completed pipeline which serves Algiers and Oran to the port of Arzew near Oran. Here it will be sold on a long term contract basis to a liquefaction company to be named CAMEL which will be owned half by Conch International and half by French interests. This plant will purify and liquefy about 100 mill. cu.ft. of gas per day (1,000 mill. cu.m. per year).

Two tankers, each of 170,000 bbl. capacity will be needed and they will be provided and operated by British Methane Limited (50% Conch International and 50% Gas Council): The ships will be built according to Conch's patented designs in U.K. shipyards. Between them they will lift about five cargoes per month for delivery to the Gas Council storage terminal at Canvey Island at the mouth of the Thames. Here the natural gas will be regasified and delivered to seven different gas boards through a pipeline which will run from the Thames to the Mersey.

REFERENCES

J. Burns and L. J. Clark, I.G.E. Comm. No. 485, 1956.
Robert H. Armston, *Gas Age*, February 25, 1954.
Ritter and Hunt, N.G.A.A. Annual Meeting, Dallas, 1961.
Schlumberger and Hunt, Annual Tanker Conference—API—June 13, 1961.
Murphy and Filstead, Fifth World Petroleum Congress, New York, 1959.
DeLury, Proceedings of 1959 Cryogenic Engineering Conference, University of California.
J. Burns and L. J. Clark, 8th International Conference, I.G.U., Stockholm, 1961.

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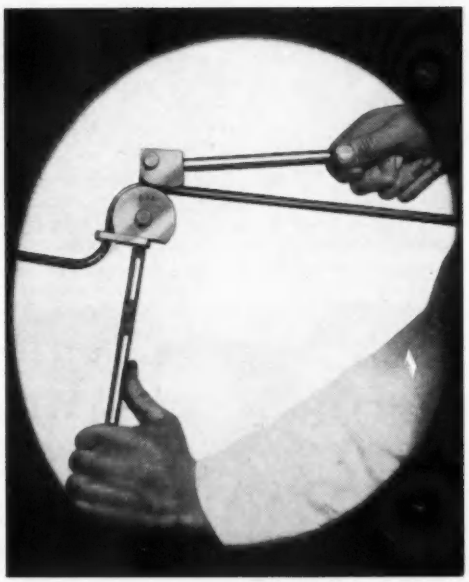
Technical developments

Small-bore tube bender

A COMPLETE range of compact, self-contained tube benders of special interest to plumbers, for small bore heating, and installation, maintenance and general engineers for instrumentation work, has recently been marketed.

Designated the Staffa Quickset benders, each size is light enough to be carried in the tool bag and is eminently



suitable for the small diameter tubing now needed for most electric, gas and water appliances as well as for many engineering applications.

The manufacturers claim that excellent commercial quality bends are made without heating or filling the tube and no work bench or stand is required. The material is instantly released on completion of the bend, with an appreciable saving in time and labour. The Quicksets are particularly useful where tubing has been partially connected and when it is undesirable to remove it for bending. —*Chamberlain Industries, Ltd.*

New mobile crane

THE Coles Leda is a fast-travelling, full-circle slewing, low-priced, mobile crane of 4 tons lifting capacity.

The Leda has a compact, more accessible structure of reduced height with a tail radius exceeding the chassis width by only one inch. It has a turning radius of 12ft.

Power for both crane motions and chassis travel is supplied by a 4-cylinder Ford diesel engine of 3.61 litre capacity developing 52 b.h.p. at 1,800 r.p.m. The Coles Leda has a maximum speed of 17.6 m.p.h. and can negotiate a gradient as steep as 1 in 3½. Range before refuelling is approximately 250 miles.

Both the steering axle wheels and the driving wheels are fully interchangeable. Foot-operated, hydraulic ly-applied brakes act on all wheels and a hand-oper ed mechanical parking brake acts on the driving wheels o ly.

These brake controls, together with the clutch p dal, gearshift, generator power-take-off and crane mo ion electric pilot switches, are all readily reached from the one driving position. The two self-centralising pilot switches, which bring into operation interlocked he vy-duty reversing contactors, are situated convenient to the driver's hand.

One combined pilot switch operates both the hoist and slewing motions and the other single switch, the derricking action. This combined two-motion pilot switch will, it is claimed, considerably speed up handling cycles. With it one can simultaneously or independently operate both the hoist and slew motions with one hand, leaving the other hand free to steer or operate the derrick motion.

Electro-mechanical brakes, spring-applied and released by a continuously-rated solenoid coil, automatically operate if the power flow is interrupted for any reason, and hold the load secure until motor current is resumed.

Limit switches prevent over-lowering and overwinding on the hoisting motion and over-derricking beyond safety limits which have been pre-determined by operating requirements.

An automatic safe load indicator is available which weighs every load and warns the operator both visually and

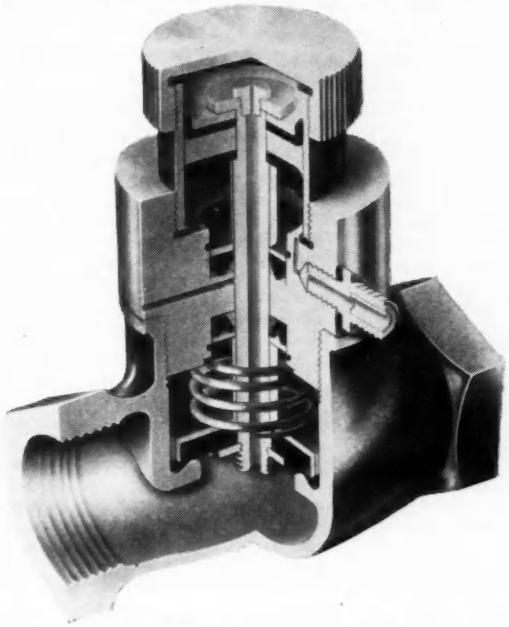
audibly of any tendency to overload the crane, and automatically prevents lifting of an unsafe load irrespective of the position of the jib.

The cantilever version, which is not equipped with outriggers, has a maximum radius of 12 ft. when fitted with a basic 11 ft. 3 in. jib; 15 ft. 9in. when fitted with 15ft. jib; and 20 ft. 9in. when fitted with 20 ft. jib.

The Leda strut when fitted with basic 20 ft. jib has a maximum radius of 19 ft. (blocked) and 17 ft. 6 in. (mobile). When fitted with its maximum jib of 50 ft., the blocked radius is increased to 30 ft.—*Steels Engineering Products, Ltd.*

New globe valve

THE Perrett Hydrovalve, which is a globe-type valve designed to control the flow of liquids or gases up to a pressure of 125 p.s.i., has been produced for operation by remote control by pneumatic or hydraulic power and is particularly suitable for inclusion in process control and automation systems.



This new valve is non-concussive in action and thus completely eliminates problems of hammering in fluid systems. Being constructed in non-ferrous metals throughout with synthetic rubber valve seats, piston cups and gland seals, it can be used with a wide variety of liquids or gases.

It is a globe valve of the 'under and over' type with renewable disc seat, and incorporates a unique feature in its design as the line pressure itself ensures a tight shut off. When the valve is closed the liquid or gas entering the inlet passes through the hollow spindle, fills the cylinder at the top of the unit and acts upon a piston. This piston, having a greater surface than the valve disc, keeps the seat firmly in the closed position despite variations in line pressure.

The application of the control pressure to the lower part of the piston overcomes the downward thrust and causes the valve to open. The rate of opening is controlled by the size of the interchangeable nozzle fitted in the bore of the hollow spindle and the control pressure necessary to open the valve is considerably lower than the line pressure.

When the control pressure is released the line pressure on the top of the piston, aided by a small phosphor bronze return spring, closes the valve. The rate of closing is again determined by the size of the nozzle which controls the charging of the upper cylinder and it is this feature which produces the non-concussive closing effect.

The Hydrovalve is simple in design and positive in action, its size being only two-thirds that of its manually operated counterpart. All components are readily accessible for servicing. A screw-in hand wheel bonnet is available for use during interim periods particularly for partially completed automatic schemes.—*The Perrett Control Company, Ltd.*

Automatic filter

THE Dalamatic automatic fabric filter embodies the fundamental dynamic air flow characteristics generally associated with some blow ring type filters, but has no mechanical moving parts.

The basic design incorporates an integrated system of standard filter units in such a manner as to enable installations to be assembled capable of handling air volumes of 100,000 cu.ft. per minute or more if required.

The Dalamatic may consist of one, two or three tier assemblies, mounted on a hopper, silo pressure vessel or conveyor. Each tier contains nine pad-type filter elements with a fabric area of 60 sq.ft. In operation, contaminated air is entrained into the filter above the level of filter elements, passes downwards between the elements and is filtered into a common outlet header running the height of the filter.

Dust initially retained on the filtering medium is removed to the hopper below the filter, and is eventually discharged. In applications with a heavy dust or product burden, a primary separator is integrated within the filter hopper, only the fines being circulated through the filter, so avoiding any tendency for fabric abrasion to become a significant factor.

Multi-assemblies can be achieved in a side-by-side arrangement, back-to-back, or a combination of both. Filtration velocities obtained are substantially greater than those experienced with filters of orthodox design.

The filter elements consist of pad-type sleeves fitting over a specially designed matrix and header. Filter media may be constructed in a variety of materials, natural or synthetic, woven or non-woven. The filter elements also act as flow straighteners and exert a significant influence or airflow stability within the filter.

The control of pressure drop caused by the deposition of collected dust on the filter medium is exercised by subjecting each vertical row of filtering elements to a concatenated cleaning cycle. Specially-designed nozzles leading from high pressure air distribution lines extending over the filter element outlets, deliver blasts of high pressure air into the filter elements in controlled sequence. This effects a momentary reversal of filtered air flow which dislodges the deposited dust. The duration of compressed air delivery is of such limited duration as to avoid significant diminution in main air throughput.—*Dallow Lambert & Co., Ltd.*

Trade Publications

A booklet has recently been issued entitled 'Gas Cleaning Cyclones.' This gives some details of the range of high performance cyclone separators, varying from standard units to tailor-made separators for particular installations. The booklet contains photographs, diagrams and performance figures.—*Head Wrightson & Co. Ltd.*

A comprehensive brochure describing the principle of electrical precipitation, and entitled 'Holmes-Elex electrical precipitators' has recently been issued. In this brochure is also described the practical application of this principle to the many control problems encountered. The wide range of electrical equipment available for use with these precipitators is also detailed.—*W. C. Holmes & Co. Ltd.*

NEWS SUPPLEMENT

MINISTER AND 'IMMENSE SIGNIFICANCE' OF THE LIQUID METHANE SCHEME

EMPHASISING the importance of not relying on the methane scheme to dissipate all their difficulties, the Minister of Power, Mr. Richard Wood, told the Gas Sales and Service Conference at Harrogate, last week, that he was none-the-less convinced of its immense significance to the gas industry. He said that apart from helping to reduce the cost of gas it should influence the prudent consumer to use more of it, knowing that the industry was right up-to-date.

He believed that the introduction of methane was a triumph for their resourcefulness, vision and courage. He added: 'It has not won you your battles, but it can help you to win them. Many of the most important battles will have to be fought and won by vigorous selling and good service. That is the real importance to me of this conference.'

DEEPLY STIRRED

Mr. Wood said ever since he came to the Ministry he had been deeply stirred by the implications of the methane scheme. The method of transportation was bold and imaginative. He would like to think that the British gas industry was leading the world in new and exciting techniques.

The matter had been given long and careful consideration and Sir Henry Jones and the Gas Council had been very patient.

In the area of the seven boards where this new raw material would give great help it would certainly not solve by itself all the gas industry's commercial problems.

It would be two to three years before the effect of methane could really be seen in the financial results of any area board.

If methane meant a break in the clouds or a breakthrough against advancing costs, its advantage would quickly disappear if the industry showed any let-up in the struggle for cheaper production.

Methane was only one of several exciting new developments which would enable the industry to begin the evolution and adaptation to the new fuel market now developing.

Mr. Wood said he did not see this evolution as a headlong retreat from the traditional coal-based structure of the industry. He saw this and other developments as a most timely supplement to established methods.

NOT DISCRIMINATORY

The Minister said the effect of the White Paper issued by the Government last spring (*Financial and Economic Obligations of the Nationalised Industries*) was in no way discriminatory against the gas industry.

He hoped it would not be suggested that Government policies, taken together, had diminished the abilities of the gas industry to compete.

When the policies had had time to take effect he believed all would agree that the industry had gained in financial strength.

They were in no mood to let up and this was certainly not the time to do so.

POWER-GAS TO BUILD REFORMING PLANT

A CONTRACT for a 60-mill. cu.ft. continuous reforming plant has been awarded to the Power-Gas Corporation, a member of the Davy-Ashmore group, by the North Thames Gas Board.

The plant is due to go into operation at Southall in July, 1963. It will use a hydrocarbon feedstock, which will be supplied to the North Thames Gas Board by pipeline from the Esso refinery at Fawley, Hampshire, says *The Financial Times*.

The Power-Gas Corporation will be responsible for all civil engineering, plant design, construction and commissioning, with the main process engineering work being carried out by the gas plant division of Power-Gas at Stockton-on-Tees.

Miss Ann Bradford holds the Gas Council Challenge Trophy, which she was awarded for her paper 'A Woman Speaks,' written when she was employed by the South Eastern Gas Board. This was presented to her at the Sales and Service Conference, Harrogate, last week, by Sir Henry Jones, Chairman of the Gas Council (right), who is holding the replica. The Minister of Power, Mr. Richard Wood, is admiring the fine workmanship on the trophy.

Annual General Meeting

AT the 11th Annual General Meeting of the London and Southern Section of the Institution of Gas Engineers recently, Mr. J. A. Hepworth, the outgoing chairman, was presented with a cheque as a mark of esteem from the members of the section.

The officers elected for the forthcoming year were, Mr. R. M. Farror, Deputy Chief Engineer of the South Eastern Gas Board, Chairman; Mr. A. F. Grant, Station Engineer, Kensal Green, Senior Vice-Chairman; and Mr. G. G. Warne, Distribution Engineer of the Southern Gas Board, Junior Vice-Chairman. Mr. Farror will represent the Section as District Member of the Council of the parent Institution for the coming year.

Members elected to serve on the Management Committee were Mr. C. H. Belben, Mr. L. J. Clark and Mr. C. H. Deas. Seven new members, Mr. F. Brown, Mr. W. Parker, Mr. E. H. Badger, Mr. W. B. Newling, Mr. G. U. Hopton, Mr. R. O. Richard and Mr. E. Ball, were elected, and three members, Mr. E. B. Eves, Mr. J. W. Kaye and H. C. Armitt, submitted their resignations from membership on taking up employment outside the industry.

8% RISE IN GAS DEMAND FORECAST: 2,868 MILL. THERMS BY 1965-66

THE preview of the Government's plans for public investment in the next financial year, 1962-63, given in a recent White Paper shows that the Government is not intending to apply the brakes severely on this sector of the economy, writes the Political Correspondent of *The Times*.

The approved total of investment is £1,840 mill, which is £200 mill. higher than estimated out-turn for 1960-61, and about £85 mill. greater than the estimate for 1961-62.

Thus the upward trend in public investment is expected to continue, and the increase would have been greater but for the action taken by the Government to rephase or hold back a number of investment programmes to relieve the pressure of internal demand.

GOVERNMENT PLEA

The Government has asked the nationalised industries to avoid investment expenditure where this can be done without damage to their financial targets or essential supplies and services.

The White Paper makes this comment on the gas industry: The Gas Council now forecasts an increase of 8% in demand for gas over the next five years from a total of 2,665 mill. therms in 1960-61 to 2,868 mill. therms in 1965-66.

Investment last year was about £5 mill. below the estimated £48 mill. due to a slower rate of work on projects than had been envisaged.

In a leader the *Financial Times* comments: It was known that the electricity authorities have been revising their expansion programmes to meet the unexpectedly sharp rise in demand, and that the gas industry envisages a major expansion programme to cut costs by the 30%, which the Parliamentary Select Committee estimates will be needed if it is to compete with electricity.

The main impact of these programmes will, however, probably come after 1963.

FRENCHMEN SEE SEGAS FLUE SYSTEM

A PARTY of 18 French architects, builders and civic leaders—also a representative of Gaz de France, the French nationalised equivalent of our own gas industry—has recently been entertained by the South Eastern Gas Board.

Members came especially to inspect the SE-Duct flue system in flats at Dulwich, Honor Oak Road and Croydon.

They were met and welcomed to the Board's Central Laboratories, Old Kent Road, by the Secretary to the Board, Mr. G. L. May, who addressed them in their own language.

Slides were shown of various SE-Duct installations, and there was a 30-minute lecture on the system—with frequent references to the models and appliances on show in the room—by M. Richalet, of SLYC, the French merchants who are agents for the SE-Duct in France.

After a 'questions and answers' session the visitors were taken to see Lewisham Borough Council flats at Honor Oak Road, Wates' flats at Urquhart Street, Dulwich, and Croydon Corporation flats at Mayday Road, Croydon. The visitors showed great interest in the system—especially with the gas drying-cabinets attached to it.

Apart from specialists from the Board's Special Services Department, others present were: Mr. H. Thornley, Chief Architect of the Croydon Borough Engineer's Department; Mr. J. Whittle, Deputy Chief Architect of the London County Council; and Mr. Crawford Sugg, of William Sugg Ltd., manufacturers of gas warm air heaters, which were in use with the SE-Duct at the flats visited.

M. Richalet, the leader of the French party (right) being welcomed to the South Eastern Gas Board's Central Laboratories at Old Kent Road by the Secretary to the Board, Mr. G. L. May. In the centre, Mr. G. H. Fuidge, Manager, Central Laboratories.

ESSO PLAN TO DREDGE SHOAL

SUBJECT to the necessary permission of the governmental authorities concerned, and in conjunction with the Southampton Harbour Board, Esso Petroleum Co., Ltd., is planning to remove by dredging the present obstacles to deep-drafted ships formed by the Nab Shoal (off the East coast of the Isle of Wight), and in the inner approaches to the Esso refinery at Fawley.

Power-Gas will build plant for I.C.I.

AN order for a CO_2 removal plant for the Severnside works of Imperial Chemical Industries Ltd. has been placed with the Power-Gas Corporation Ltd., a member of the Davy-Ashmore Group.

The plant will be used for the removal of CO_2 from a synthesis gas stream, and is the second operating with the Benfield hot potassium carbonate process to be constructed for I.C.I. by the Power-Gas Corporation.

The Power-Gas Corporation is responsible for the complete process and engineering design, manufacture and procurement of plant. It will erect the plant on foundations designed by the P.G.C. civil engineering department.

The plant is scheduled for completion early in 1963.

CAMBRIDGE MS PLANT IS OPENED BY MAYOR

AT the invitation of the Eastern Gas Board the Public Health Committee of the City of Cambridge visited the Cambridge gasworks for the official opening of the new MS plant by the Mayor of Cambridge, Councillor Arthur Halcrow, J.P. The party included the Chairman of the Committee, Alderman C. Elliott Ridgeon, the Deputy Chairman, Alderman E. T. Halnan, with the Chief Public Health Inspector, Mr. J. F. Edwards.

The Eastern Gas Consultative Council was represented by Colonel R. I. Musson, Chairman, and also present were members of the Cambridge Divisional Committee including Alderman F. Doggett, Chairman.

The guests were received by Mr. J. H. Dyde, Board Chairman; the Deputy Chairman, Mr. F. T. Brookes, and Mr. G. Calder and Mr. W. C. Kincaid (Members of the Board), with Mr. J. Hunter-Rioch, the Divisional General Manager.

Mr. Dyde welcomed the guests in the control room of the plant, describing the occasion as a further opportunity to confer with representatives of the City, and discuss the various processes involved in supplying the gas requirements of Cambridge and the surrounding district.

Mr. Dyde recalled that the MS plant provided factual evidence that the promise which he, as Chairman of the Board, made to representatives of the City Council two years previously, had been fulfilled.

Not only the Health Committee, but the Board had been concerned about the discharge of dust from the works, which gave rise to numerous complaints over a prolonged period from residents in the neighbourhood. Despite many endeavours to improve matters by the Board's engineers, it was realised that the only answer was the replacement of old plant by one which could not be responsible for dust or smoke.

It was appropriate, continued Mr. Dyde, that this plant—the first of its kind in Great Britain—should 'see the light of day first in this scientifically-minded place and also at our Cambridge works where, particularly in regard to technical processes it has always been in step with modern development . . . . we are determined to give you nothing but the best.'

DUST AND SMOKE

After explaining the plant, the Chairman said that it completely overcame the dust and smoke problem, thus making another contribution on the part of the gas industry to the cleansing of the skies from pollution.

The Mayor claimed a lengthy association with the gas industry, dating back to 1901, when his father was first employed by the former Cambridge University and Town Gas Light Company.

Expressing his personal pleasure and that of the representatives of the City Council who accompanied him, Councillor Halcrow referred to the discussions which had taken place between the Board and the Council, and said that on all occasions they had been received with great courtesy and understanding.

'While we of the City Council are quick to complain, I hope you will find us equally quick to commend when occasion demands,' said the Mayor.

After the commemorative plaque had been unveiled, Mr. Dyde concluded the proceedings by thanking the engineers who had contributed a 'wonderful amount of first-class work to get the plant in operation in time to meet my promise.'

ROOF-TOP BOILER ROOM USES GAS

EVERYWHERE today space is at a premium. This is borne out by the present astronomical price of land and the greater height of buildings.

The occupier of new premises is very careful to make the fullest use possible of the floor area he has available and is, therefore, loath to set aside more than the minimum amount of floor area for the housing of non-productive plant and equipment.

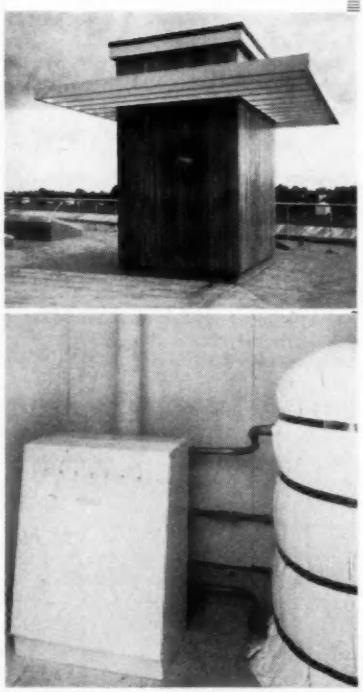
An example of this problem arose recently at Southend, where the firm of E.K. Cole Ltd., was building a four-storey works office block.

The North Thames Gas Board was consulted on the question of the provision of hot water for toilets on two of the floors. A storage system was recommended, but there was no floor space available.

It was then suggested that the boiler and hot water cylinder could be sited on the roof immediately above the toilets, a position which also allowed for simple ventilation.

This suggestion was accepted, and a Kayenco P.45 gas-fired boiler and a 40-gallon hot water cylinder were installed and a boiler room constructed.

As the work progressed it became apparent that the roof-top boiler room would be visible when viewing the front of the building. The architects added a wooden canopy around the top of the boiler room giving a pleasing pagoda effect.



External view of the roof-top boiler room at the new E.K. Cole Ltd., office block, showing the pagoda effect of the wooden canopy. Below: The Kayenco P.45 gas-fired boiler and 40-gal. hot water cylinder neatly installed in the roof-top boiler room.

Ulstermen see how quick and clean gas is

DURING the 16 days of the recent *Belfast Telegraph* Ideal Home Exhibition approximately 200,000 people visited the hall.

The majority visited the first-ever gas pavilion presented by Belfast Corporation Gas Department, in co-operation with the manufacturers of gas appliances.

Occupying an advantageously-sited 80 ft. of frontage on the ground floor, the gas pavilion was of great interest to visitors from Belfast and provincial areas.

The centre-piece of the pavilion was the model all-gas kitchen, flanked on the right by a special heating display and on the left by a section devoted to instantaneous water heaters.

The Cookery Advice Centre at the end of the Pavilion was staffed by the Department's cookery demonstrators, including the senior demonstrator, Miss Dorothy Lytle, who is well-known to Ulster television viewers through her frequent appearances.

The general display included wash boilers, refrigerators, and the latest cookers with eye-level grills and turn-spits. Apart from the appliances set out along the front of the stand, all appliances were live.

The streamlined kitchen unit, in attractive colours of coffee and white relieved by touches of tangerine and lime-green, attracted many visitors and elicited much favourable comment.

The unit was constructed by Hygena Ltd. to accommodate the Radiation 72A oven and 72R hotplate, the Morley 59 GE washing machine, the Ascot 715/1 balanced-flue water heater and the Electrolux MB.16 refrigerator.

The heating section proved very popular and drew many enquiries. In the background, a partitioned stand displayed the latest in gas fires. Central heating boilers and warm-air units occupied the side wall and foreground.

There is no doubt that, with the introduction of a favourable two-part tariff in the next few weeks, considerable business will ensue.

The fascination of playing with instant hot water attracted crowds to the water-heating section and resulted in a rush of requests for quotations to supply and instal instantaneous water heaters.

A curtained cubicle, the shower in which was supplied by an Apollo water heater, greatly appealed to occupiers of houses without bathrooms.

Many visitors were noticeably surprised by the variety and modern design of the appliances on show. The mounting of the pavilion was obviously necessary in order to implant in the minds of the public the concept of modernity of gas appliances.

Sales at the exhibition and later in the showrooms demonstrated clearly the value of the co-operative effort put into the planning of the pavilion.

The seed sown in 200,000 minds should bear much fruit in the months to come.

South Australian gas profits and sales increase

THE South Australian Gas Company made a net profit for the year ended August 31, 1961, of £113,211 after providing £22,358 for income tax, compared with £110,077 last year, when the income tax provision was only £494.

Dividend at the rate of 6% absorbed £29,294.

Although there was a considerable reduction in gas consumed by some sections of industry, particularly the motor body building industry and home appliance manufacturers, over-all industrial and commercial gas sales were 10 mill. cu.ft. above last year and the total sales were a record.

Appliance sales were extremely buoyant in the first six months of the year but the latter half was affected by credit restrictions and unemployment.

However, as a result of strong sales promotion, the value of appliances sold during the year was once again a record.

PERSONAL NOTES

MR. D. C. BERTRAM has been appointed Group Engineer with responsibility for Romford, Lea Bridge, Ascot, Slough and Uxbridge works, in the North Thames Gas Board. MR. T. BISPHAM has been appointed Station Engineer, Southall, with status of Group Engineer and responsibility for Brentford works. MR. A. F. GRANT becomes Station Engineer, Nine Elms with the status of Group Engineer, MR. C. P. N. COX becomes Station Engineer, Kensal Green, MR. R. T. DE GRUCHY, becomes Station Engineer, Brentford, and MR. G. F. I. ROBERTS, Deputy Station Engineer, Southall. MR. G. L. BRAIDWOOD is Station Engineer, Slough, MR. M. GREGORY is Station Engineer, Stratford, MR. R. BAIRSTOW becomes Deputy Station Engineer, Bromley, MR. P. C. EGAN, Assistant Engineer, Bow Common, and MR. T. C. TWEDDELL, Senior Assistant Engineer, Kensal Green.

MR. F. P. S. STAMMERS, Chairman and Managing Director of Radiation, Ltd., who is at present in Australia, has had to go into hospital in Melbourne for an eye operation. Surgically speaking, the operation is not an unusual one, but will necessitate a lengthy period of post-operative treatment. It is likely to be about eight weeks before he returns to this country.

OBITUARY

MR. E. S. CAPLIN, transport manager of the North Thames Gas Board has died at the age of 60. Mr. Caplin had been the Board's transport manager since 1949, and altogether had served the Board for 31 years. Mr. Caplin joined the former Gas Light and Coke Company's motor repair shop in 1930, being appointed manager there after returning from war service in 1946.

MR. J. D. STOTHART, Australasian manager, West's Gas Improvement Company Ltd., died suddenly in Sydney, aged 54. He joined West's Gas Improvement Company as a pupil in 1925 and went to Australia in 1936 as Assistant to MR. F. E. BIRD, who was then Australasian manager of the Company. On the death of Mr. Bird in 1939, he was appointed manager.

MR. W. F. DINES, director and general works manager of the Midland Tar Distillers Ltd., has died. Mr. Dines joined the Midland Tar Distillers Ltd. in 1949. He joined the Board at the beginning of 1960.

MR. F. RITSON, formerly chief engineer of Gas Chambers & Coke Ovens Ltd., now merged with West's Gas Improvement Co., Ltd., has died at the age of 73.

MR. R. L. HALL has been appointed Station Engineer, Poole, in the Southern Gas Board, and succeeds the late MR. N. W. HULLAH. Mr. Hall, who began his career as an apprentice to a pharmaceutical chemist, joined the Bournemouth Gas and Water Company in September 1922. Apart from a brief period at Alderney waterworks he has been at Poole works continuously and was appointed assistant works superintendent in December 1939 and assistant station engineer in 1958. MR. J. F. DORAN, who has been sales manager of the Board's Southampton region for the past four years is appointed Sales Manager of the Dorset and Bournemouth region. This appointment has not been filled since the retirement of MR. S. H. EDWARDS two years ago. Mr. Doran joined the Southern Gas Board from the North Thames Gas Board in 1957. MR. D. M. FOULIS, who has been acting sales manager was recently appointed Service Manager to the Board. MR. W. J. STEED is appointed Sales Manager of the Southampton Region. Mr. Steed has been assistant commercial manager at Board Headquarters since coming from the East Midlands Gas Board three years ago.

MR. C. T. BAKER-CARR, of Radiation New World Ltd., is progressing favourably in Nottingham General Hospital after his accident on the way to the Gas Sales and Service Conference at Harrogate last week. He is expected to be indisposed until just before Christmas.

MR. C. A. LEWIS has been appointed Technical Consultant to G. & R. Gilbert (Industrial) Ltd., Hackbridge, Surrey. Mr. Lewis is well-known in the gas industry from his long association as a director of Radiant Heating Ltd.

COMING EVENTS

November 28.—I.G.E., LONDON AND SOUTHERN SECTION: 'The Use of Instruments in the Production and Distribution of Gas,' by J. R. Kenward. 2.45 p.m.

November 28.—THE COMBUSTION ENGINEERING ASSOCIATION, NORTH WESTERN REGION: Manchester. 'Liquid Petroleum Gas—the Present and Future Position in U.K.'

November 30.—NORTH THAMES G.C.C.: Westminster City Hall.

December 1.—LONDON AND SOUTHERN JUNIORS: 'The Safe Operation of Mechanical Handling Plant,' by R. W. Cutts.

December 5.—SOUTH EASTERN G.C.C.: Caxton Hall, Westminster. 11 a.m.

December 6.—EASTERN JUNIORS: Joint Meeting with the Eastern Section of the I.G.E.

TRADE NOTES

BELLS ASBESTOS AND ENGINEERING HOLDINGS LTD. has declared an interim dividend of 7½% less Income Tax, on the 5s. Ordinary Shares of the Company payable on October 27, 1961. It is also announced that subject to the approval of the Company in general meeting, the Directors propose to issue 2,193,280 new Ordinary Shares of 5s. each, credited as fully paid, to Ordinary Shareholders registered on October 27, 1961 in the proportion of one new Ordinary share for every two Ordinary Shares held on that date. The Directors intend to accede to the request of the Chancellor of the Exchequer with regard to dividend restraint when considering the Final Dividend on the Ordinary Shares for the year ending December 31, 1961.

CAMBRIDGE INSTRUMENT CO. LTD. and **ISTRUMENTI DI MISURA C.G.S., S.p.A.,** Monza (Milan—Italy). announce final agreement for the formation of a new joint company, **CAMBRIDGE—C.G.S.—S.p.A.** Cambridge—C.G.S. will initially manufacture instruments based on Cambridge designs, including electronic and galvanometric indicators and recorders for a wide range of applications, and associated control equipment. These will, where necessary, be adapted to meet the requirements of the Italian and neighbouring markets.

PLASTIC PIPE MANUFACTURERS SOCIETY: The plastic pipe industry, which represents a considerable section of the general plastic industry of the country, has now seen the formation of the Plastic Pipe Manufacturers Society, of which 16 of the major companies have become members. The Chairman of the new society is Mr. F. H. A. Mackrill.

LINCOLN FURNACES LTD., has issued a 17-minute colour film on warm air central heating. The film, made by Val Productions of Ontario, Canada, describes the principles and advantages of warm air as a house-heating medium in a manner suited to both technical and non-technical audiences.

HAGAN CONTROLS LTD., which specialises in control engineering and is one of the Plessey Group of Companies, has moved from 14, Grosvenor Place, London, W.1, to Weedon Road, Northampton (Telephone Northampton 260).

PYRENE-PANORAMA LTD., Brentford, Middlesex, announce that Miss B. P. Park, formerly with Optoshield Ltd., has been appointed Sales Manager of their Eye Protection Department.